SUPPLEMENTAL TOUCH SCREEN LCD PANEL

BACKGROUND OF THE INVENTION

Technical Field

This invention relates to computer systems, and more particularly to a supplemental LCD panel for use with either a desk top or a lap top computer system which enables the tool bar of the program running on a display of the computer system to be displayed thereon and further activated by touch or via a mouse.

Discussion

Personal computer systems which have become extremely popular in both business and home use. Such computer systems typically consist of a computer, a monitor and a Graphical User Interface ("GUI") based operating system. An example of such a system is an personal computer running the Windows NT® operating system, a keyboard, a mouse and a cathode ray tube ("CRT") or LCD display monitor.

With many present day software programs adapted to run on such desk top and lap top computer systems, one or more tool bars, menu bars or status bars are typically provided. These items enable the user to monitor and/or control various functions of the software. They also enable the user to perform various operations such as printing, saving or deleting new or existing files created or accessed by the particular software program. Often these bars occupy a significant portion of the available display area of a CRT, a liquid crystal display (LCD), or other form of monitor. Typically the tool, status or menu bars are disposed above along the top and bottom of the display. The

various operations which may be controlled through these bars are typically effected by using the mouse. The tool bar typically incorporates various functions which may be initiated via the mouse and/or may provide a drop down menu when a particular function is selected. The drop down menu provides the user with additional options which may be accessed by either single or double clicking with a mouse, if the mouse has been previously released, or simply by releasing the left or right button on the mouse once the mouse cursor has been positioned over the desired item on the drop down menu.

In view of the foregoing, it will be appreciated then that the display of one or more tool, menu and/or status bars requires can require that a significant percentage of the usable display area of a CRT or an LCD monitor be dedicated to these items. The need for controlling such tool bars through a mouse not only requires the use of valuable display area on the CRT or LCD, but also requires the user to remove one hand from the keyboard in order to control the mouse when using the tool bars. In many software applications, the user is required to continually use one or more tool bars to control the application, such as with various computer aided design software. The need to constantly remove one hand from the keyboard, grasp the mouse, orient the mouse while viewing the CRT or LCD to place the mouse cursor where it is needed on the screen, single or double click the mouse, and finally return the hand to its proper orientation on the keyboard represents a very significant operating inefficiency. This action also requires the user to constantly refocus his/her viewing between the monitor, mouse and keyboard each time the user needs to reach for the mouse to control a tool bar function.

In view of the foregoing, it would be highly desirable to provide a supplemental display system which is capable of interfacing with a computer system and/or an existing display system in order to display one or more tool, status and/or menu bars of the software application being run on the computer. This would eliminate the need to display these items on the CRT or LCD, which would significantly increase the usable amount of display area on the monitor for displaying useful text or graphical information, or a combination of

both, depending upon the software application being run. Thus, more information could be displayed to the user at any given time since the space normally required for the tool, menu and/or status bars on the monitor would now be available for displaying additional text and/or graphics information.

It would further be highly desirable to provide a supplemental display system which can be interfaced with a computer system and positioned close to a keyboard to not only display one or more tool, menu and/or status bars of a software application thereon, but which also allows a user to control the tool and/or menu bars from the supplemental display simply by touching the display to activate the particular function needed. In this manner, the user would not need to take hold of the mouse and reorientate his/her eyes on the primary display screen to use the tool and menu bars. This would significantly reduce the inefficiency introduced by the use of a mouse and the displaying of the tool bars on the monitor.

It would further be highly desirable to provide a supplemental computer display system for displaying one or more tool, menu and/or status bars of a software application thereon, where the supplemental display system is adapted to be located at various locations on a monitor and movable relative to the monitor to fit the preference of the user.

SUMMARY OF THE INVENTION

The above and other objects are provided by a supplemental liquid crystal display (LCD) system in accordance with a preferred embodiment of the present invention. The supplemental LCD system is comprised of an intelligent LCD panel having a length suitable to be placed along one dimension of a primary display monitor. The supplemental LCD panel may comprise a component which is adapted to be placed adjacent the keyboard as a free standing component of the computer system or it can be built into the keyboard.

In one preferred embodiment the supplemental LCD panel is disposed within a portion of the keyboard at a position above the keys so as to be easily accessed while using the keyboard. The supplemental LCD panel in this

embodiment comprises a touch sensitive overlay. The overlay enables the user to access the various functions of the tool and menu bars displayed thereon simply by touching the point on the LCD panel where the desired function icon of the tool or menu bar appears. In this manner the user does not need to remove one hand and reach away from the keyboard area, such as is required when using a mouse to select functions from a tool or menu bar. Instead, both hands of the user remain close to the keys of the keyboard. This significantly increases the efficiency of the user in many software applications where the user is required to use one or more tool and/or menu bars frequently while using the software.

In the embodiment described above, the present invention incorporates a controller touch panel (CTP) application that runs on the computer system. The CTP application allows the user to assign tasks to the CTP using a simple user interface. The software application running on the personal computer interprets user input from the supplemental LCD panel and translates that input into appropriate commands that are forwarded to user applications and/or the computer's operating system as required.

In the preferred embodiment, the present invention uses an embedded CTP application which is stored in non-volatile random access memory (RAM) to generate a "virtual" cursor that appears on the supplemental LCD panel. In this manner, the user may use the mouse to select (i.e., highlight) a portion of information on the primary display, and then move the mouse to an edge of the primary display, whereupon the embedded CTP application generates a mouse cursor on the supplemental LCD panel to enable the user to select the function desired through the use of the mouse. Thus, for those functions where highlighting portions of information on the primary display are not needed, the user may select the needed function solely by activating the function from the supplemental LCD panel. For those operations that are best or most easily accomplished with the use of a mouse, for example, the highlighting of text or drawing of graphics on the primary display, the present invention works with the mouse to enable the user to select functions being displayed on the supplemental LCD panel via the mouse.

In various other preferred embodiments a means is disclosed for hingedly supporting the supplemental LCD panel along one dimension of a primary display monitor. In another alternative preferred embodiment one or more supplemental LCD panels are hingedly coupled to a keyboard portion of a laptop computer such that the advantages of the present invention can be realized when operating a lap top computer. Various other alternative preferred embodiments incorporating one or more supplemental LCD panels are disclosed.

BRIEF DESCRIPTION OF THE DRAWINGS

The various advantages of the present invention will become apparent to one skilled in the art by reading the following specification and subjoined claims and by referencing the following drawings in which:

Figure 1 is a perspective view of a supplemental LCD panel in accordance with the present invention housed within a keyboard of a computer system;

Figure 2 is an enlarged perspective view of a portion of the supplemental LCD panel shown in Figure 1;

Figure 3 is a simplified block diagram of the major components of the supplemental LCD panel shown in Figure 2;

Figure 4 is a simplified block diagram of the supplemental LCD panel in communication with a personal computer;

Figure 4A is a diagram of a first software component used with the present invention;

Figure 4B is a diagram of a second software component used with the present invention;

Figure 5 is a perspective view of an alternative preferred embodiment of the present invention showing a pair of supplemental LCD panels hingedly attached to each other and hingedly attached to a keyboard;

Figure 6 is a perspective view of the pair of supplemental LCD panels of Figure 5 illustrated in the closed position.

Figure 7 is a perspective view of an alternative preferred embodiment of the display system of Figure 4 illustrating a supplemental LCD panel which is removably coupled to a primary monitor via a communications cable;

Figure 8 is a view of the rear of the two LCD panels shown in Figure 7 illustrating how the supplemental LCD panel couples to the primary monitor;

Figure 9 is an enlarged perspective view of a portion of an alternative embodiment of the primary monitor shown in Figure 8 illustrating a cover portion thereof in a closed position covering an electrical connector which is used for mating with a communications cable of the supplemental LCD panel;

Figure 10 is a perspective view of the rear portion of the primary LCD

monitor of Figure 9 with the cover portion open and the communications cable of the supplemental LCD panel ready to be secured to the exposed electrical connector;

Figure 11 is a perspective view of a supplemental LCD panel disposed along a vertical edge of a primary monitor;

Figure 12 is a perspective view of the supplemental LCD panel shown in Figure 11 attached along a horizontal edge of one of the primary LCD monitors;

Figure 13 is a perspective view of a plurality of supplemental LCD panels hingedly attached to a pair of primary LCD monitors illustrating how the supplemental LCD panels may be rotated so as to be disposed in a vertical orientation or a horizontal orientation to suit the specific software being used and/or the user's preference;

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to Figure 1, there is shown a touch sensitive, supplemental liquid crystal display (LCD) panel 10 housed within a computer keyboard 12, which is in turn electrically coupled to a primary display monitor illustrated as a dual screen LCD monitor system 14. An optional mouse 16 allows a user to control the various tool and menu bars that are typically used with many software applications. The primary display monitor 14 need not be a dual screen system, and need not comprise LCD panels. Virtually any other form of display system could be used as the primary display monitor.

As will be appreciated, the supplemental LCD panel 10 makes the use of the mouse 10 substantially or completely unnecessary to access and control the functions associated with the tool and/or menu bars. The supplemental LCD panel 10 displays one or more tool, menu and/or status bars of a software program running on a computer (not shown) associated with the keyboard 12. This enables a significant percentage of display area of the primary display monitor 14 to be used for displaying useful text and/or graphics information. The supplemental LCD panel 10 also enables a user and to

activate one or more functions of a tool and/or menu bar simply by touching one or more portions of the LCD panel 10. The LCD panel 10 may vary significantly in dimensions, but in one preferred embodiment extends almost the full length of the keyboard 12.

Referring to Figure 2, a portion of the supplemental LCD panel 10 is illustrated in enlarged fashion. The LCD panel 10 incorporates a LCD segment 20 which is mounted within a portion of the keyboard 12 preferably above the keys. Although Figure 2 illustrates the LCD panel 10 built into the keyboard 12, the LCD panel 10 could also comprise a stand-alone unit adapted to be placed closely adjacent the upper edge of the keyboard or anywhere else that the user prefers. The LCD panel 10 could also be mounted physically by external hardware to the upper edge of the keyboard 12 above the function keys thereof.

The LCD segment 20 includes a touch sensitive (i.e., resistive) overlay 22 which enables a user to select specific function boxes 26a, 26b, 26c, or 26d of a tool bar 24 simply by touching the surface of the LCD segment 20 over the desired function box. For those function boxes 26 which produce a drop down menu when touched, the user merely touches the tool bar item desired and then drags his/her finger down to the specific item in the drop down menu, and then lifts his/her finger off of the overlay 22 to select that specific sub-function. While only four function boxes 26a-26d are shown in Figure 2, it will be appreciated that the overall length and height of the supplemental LCD panel 10 enables a relatively large plurality of function boxes to be displayed. Also, menu and/or status bars may also be displayed simultaneously with one or more tool bars 24. The primary limiting factor on the number of tool, menu and/or status bars displayed on the LCD panel 10 are the overall dimensions of the LCD segment 20.

The supplemental LCD panel 10 thus enables the user to select many functions from the tool bar 24 and any other menu bar(s) without the need to access a computer mouse. This significantly increases the efficiency in using the computer system since the user does not need to repeatedly remove one hand from the keyboard, grasp the mouse, orient the mouse and its cursor to

the desired spot on the primary monitor, single or double click the mouse, and then return his/her hand back to the keyboard while looking at the keyboard to verify correct hand placement on the keys. The position of the LCD panel 10 closely adjacent the keys also enables the user to much more quickly position the hand that has been used to engage the LCD overlay 22 back on the keyboard 12 at its correct position on the keys. The elimination of constantly reaching for the mouse and repositioning one hand back on the keyboard at its correct orientation serves to significantly increase the productivity of the individual plus significantly reduce user fatigue.

Referring to Figure 3, a simplified electrical schematic block diagram of the supplemental LCD panel 10 is shown. The panel 10 incorporates a central processing unit (CPU) 30, a volatile memory (RAM) 32, a non-volatile memory (i.e., flash RAM) 34 and an input/output circuit 36. Each of subsystems 30-36 communicates with the supplemental LCD display segment 20 and the touch sensitive overlay 22 via a suitable data bus 38. The CPU 30 performs all computing functions including running the operating system and application programs, providing images to the LCD segment 20, and sending and receiving data to and from the input/output circuit 36. The volatile RAM 32 holds temporary data required for application operation. The non-volatile RAM 34 holds the operating system and application program. The non-volatile RAM 34 retains its data independently of its power state.

The LCD segment 20 preferably comprises a high-resolution color or monochrome screen capable of displaying a Graphical User Interface. It will be appreciated, however, that virtually any other form of display could be used in lieu of a liquid crystal display. At present, though, a liquid crystal display forms a very compact, lightweight, high contrast display means ideally suited for the purpose of the present invention.

The touch sensitive overlay 22 preferably comprises a well known, transparent, resistive, touch sensitive membrane that covers the active portion of the LCD segment 20. The overlay 22 translates any pressure applied to its surface such as that resulting from contact with a human finger into a message to the CPU 30 describing the exact X-Y location of the contact point. The

input/output circuit 36 provides bi-directional high-speed communications between the LCD panel 10 and the computer with which it is operating using an industry standard communication protocol such as a Universal Serial Bus (USB).

It will be appreciated that other technologies could be used to implement the touch sensitive overlay 22. For example, capacitive sensing and/or surface acoustic wave technology could be used to form the touch sensitive overlay if desired. Also, while the present invention has been described as comprising a LCD segment, other display technologies could easily be employed in place of liquid crystal technology.

With brief reference to Figure 4, the supplemental LCD panel 10 is shown with the input/output circuit 36 coupled via a high speed communication bus (USB) 40 to an input/output communications circuit 42 of a personal computer (PC) 44. Accordingly, the LCD panel 10 can quickly and easily be coupled to a PC 44 provided a free USB port of the PC 44 is available. This makes the supplemental LCD panel 10 retrofittable to virtually any PC which incorporates such a communications bus.

With reference to Figures 4A and 4B, the supplemental LCD panel 10 includes a first software component 48 (Figure 4A) which is stored in the non-volatile RAM 34 and a second software component 50 (Figure 4B) that runs on the personal computer which the LCD panel 10 is being used with. Referring specifically to Figure 4A, the modules of the first software component 48 are shown. These modules comprise an embedded operating system 52 such as Microsoft CE® available from Microsoft Corporation®, a touchscreen driver 54, a video driver 56, a CTP embedded application 58 and a communications driver 60. The touchscreen driver 54 reports messages from the touchscreen overlay 22 to the CPU 30. The video driver 56 translates input from the CPU 30 into a form suitable for display on the LCD display segment 20. The CTP embedded application 58 performs a number of tasks. These tasks involve 1) accepting input from the CTP interface application as to what graphical interface to display; 2) working with the display driver to display the required graphical interface; 3) interpreting user input as

invocations of the functions represented by the current graphical user interface and reporting this input back to the CTP interface application through the communications driver 60; and 4) accepting input from the LCD panel 10 to generate a mouse cursor in response to user mouse operations (i.e., move, click, double click, etc.) . The communications driver 60 manages bi-directional data exchanges between the input/output subsystem 36 and the CPU 30.

Referring specifically to Figure 4B, the second software component 50 consists of a CTP interface application 62 and a communications driver 64. The CTP interface application 62 performs the following functions: 1) providing the user with a means of selecting what interface components he/she would like assigned to the supplemental LCD panel 10; 2) sending an appropriate graphical representation of the selected interface component to the LCD panel 10 for display; 3) accepting user input from the LCD panel 10, translating that input into appropriate commands and sending those commands to the users application or operating as a function call; and 4) providing a method whereby the user can move his/her mouse cursor from the primary display monitor "onto" the LCD segment 20 of the supplemental LCD panel 10. The communications driver 64 manages communications between the communications port of the user's computer system that is hosting the LCD panel 10 and the CTP interface application 62.

The generation of a mouse cursor on the supplemental LCD panel segment 20 enables a user to use the mouse on the primary monitor system 14, and then to move the mouse cursor "onto" the supplemental LCD panel display segment 20 to select the function or operation to be performed on the highlighted text and/or graphics. In this manner the present invention allows the mouse to be used in the same fashion as it would be as if the tool or menu bars were being displayed on the primary display system 14.

The supplemental LCD panel 10 can therefore operate independently from the primary monitor 14 of the user's computer system, thereby allowing the user to turn off the primary monitor while still receiving information through the LCD panel 10. With its touchscreen feature, the LCD panel 10 also

enables various types of handwriting recognition and signature capture provided a stylus is incorporated therein.

Referring now to Figure 5, a pair of touch sensitive, supplemental LCD panels 100 are illustrated hingedly coupled to one another via hinges 102 and also to a keyboard 104 via hinges 106. With brief reference to Figure 6, the two panels 100 are shown in a closed orientation. The top most panel 100 in Figure 5 folds down onto the lower panel 100 when the panels are not needed.

Referring now to Figures 7 and 8, a supplemental LCD panel 200 is illustrated coupled to a primary LCD monitor 202 via a suitable communications cable 204. In this embodiment the LCD panel 200 may include a touch sensitive overlay or may function simply as a supplemental display for one or more tool, menu and/or status bars used with the software application being run. In Figure 8 it can be seen that the LCD panel 200 includes a tab 206 which is received in a suitable recess 208 in a rear surface 210 of the primary monitor 202. When the tab 206 is inserted in the recess 208 the supplemental LCD panel 200 is securely attached to the primary monitor 202. Alternatively, a suitable hinge structure could be included as part of the tab 206 to allow the LCD panel 200 to be rotated so that it can be placed at an optimum viewing angle for the individual.

Referring now to Figure 9, the communications cable 204 of the supplemental LCD panel 200 is shown having a suitable electrical connector 214 on one end. The electrical connector 214 is coupled to a mating electrical connector 216 of a primary monitor 218. In this instance the monitor 218 is identical to the monitor 202 with the exception of a recessed area 220 formed along one rear edge of a housing of the monitor 218. The recess 220 includes a slidable cover 222 (Figure 10) which, when in an open position, exposes the connector 216. When the supplemental LCD panel 200 is not in use, the cover 222 can be urged upwardly into the position shown in Figure 10 to cover the electrical connector 216.

Referring to Figure 11, the supplemental LCD panel 200 is shown coupled to one of a pair of primary LCD monitors 202 so as to extend in a vertical orientation. Figure 12 illustrates the LCD panel 200 in a horizontal

orientation. It will therefore be appreciated that the LCD panel 200 can be used in a variety of orientations to suit the specific requirements of the software application which the user is operating. Additionally, one end of the supplemental LCD panel 200 could be hingedly attached at one corner of either primary LCD monitor 202 to allow the panel 200 to be rotated 270° from the horizontal orientation shown in Figure 12 into the vertical orientation shown in Figure 13. Obviously, suitable software would be needed to "flip" the display of information on the panel 10 so that same can be easily read.

Referring to Figure 13, an example of the hinged mounting capability of the supplemental LCD panel 200 is illustrated. A hinge mechanism 224 coupled to the panel 200 allows it to be rotated about a corner of one of the primary LCD monitors 202 between a horizontal and a vertical orientation. Alternatively, a hinge 226 disposed at the adjacent sides of the monitors 202 allows the LCD panel 200 to be rotated so as to be on top of one or the other of the monitors 202. An identical hinge 228 could be included at a lower adjoining edge of the monitors 202 to permit an LCD panel 200 to be rotated from one monitor 202 to the other along a bottom horizontal edge 230 of each monitor 202. Still further, one or more larger, supplemental LCD panels 232 could be coupled via a suitable mounting member to the monitors 202 if needed.

From the foregoing, it will be appreciated that the various preferred embodiments of the present invention all enable one or more tool bars that would ordinarily be displayed on a primary monitor to be displayed separately on a supplemental LCD panel to thereby significantly increase the useable display area on the primary monitor. In certain preferred embodiments the supplemental LCD panel incorporates a touch sensitive panel which allows the user to not only view the various tool, menu and/or status bars used with the software application, but also to select various functions merely by touching the function boxes of the tool or menu bars with one finger. This significantly increases the efficiency of the user in operating most software applications, and especially those which require repeated access of the tool bar, such as various computer aided design software applications. With these

embodiments, there is no need for the user to manually reach for a mouse, orientate the mouse on a mouse pad while watching the display, and move the mouse cursor to the desired function box. The touch control of the touch sensitive, supplemental LCD panel significantly reduces user fatigue by allowing the user to maintain both hands close to the keys of the keyboard while controlling the various function boxes of the tool and/or menu bars as needed.

The preferred embodiments further can be easily retrofitted to existing keyboards or mounted on one or more LCD display panels in such a manner as to be moveable into various orientations to suit the specific software being used. The various preferred embodiments are also easily coupled to an existing USB port of a personal computer and therefore do not require modification of the hardware of a personal computer. The supplemental LCD display panel can also be used with a laptop computer if desired.

Those skilled in the art can now appreciate from the foregoing description that the broad teachings of the present invention can be implemented in a variety of forms. Therefore, while this invention has been described in connection with particular examples thereof, the true scope of the invention should not be so limited since other modifications will become apparent to the skilled practitioner upon a study of the drawings, specification and following claims.